1. A method of designing a metamaterial structure having a required permeability at a predetermined frequency, the metamaterial structure including a frequency selective surface located proximate to an electrically conductive layer, the method comprising:

relating the required permeability to a required surface impedance of the apparatus at the predetermined frequency; and

configuring the metamaterial structure so as to obtain the required surface impedance, the apparatus thereby having the required permeability.

2. The method of claim 1, wherein the required permeability includes a required real permeability, the required surface impedance includes a required surface reactance, the required real permeability being related to the required surface reactance.

3. The method of claim 1, wherein the required permeability includes a required imaginary permeability, the required surface impedance includes a required surface resistance, the required imaginary permeability being related to the required surface resistance.

4. The method of claim 1, wherein configuring the metamaterial structure so as to obtain the required surface impedance includes selecting a frequency selective surface having a resonance frequency proximate to the predetermined frequency.

5. The method of claim 1, wherein configuring the metamaterial structure so as to obtain the required surface impedance includes optimizing the frequency selective surface using an optimization algorithm.

6. The method of claim 5, wherein the optimization algorithm is a genetic algorithm.

7. The method of claim 1, wherein the frequency selective surface is disposed on a first side of the a dielectric substrate, and the electrically conductive layer is disposed on a second side of the dielectric substrate, the dielectric substrate having a dielectric thickness substantially less than the wavelength of electromagnetic radiation at the predetermined frequency.

8. An electromagnetic device including the metamaterial structure designed by the method of claim 1.

9. A method of designing a metamaterial structure having the properties of a ferrite film supported on a conducting ground plane, the metamaterial structure including a high impedance frequency selective surface, the method comprising:

relating a required permeability of the metamaterial structure to a surface impedance of the metamaterial structure,

the required permeability having a required real component of permeability denoted μ_r', the surface impedance having a surface reactance denoted X_{S1}, wherein

$$\mu_r' = \frac{X_{S1}}{\eta_0 \beta_0 d},$$

the value of surface reactance being chosen so as to provide the required real component of permeability.

10. The method of claim 9, wherein the required permeability further includes a required imaginary component μ_r'', the required surface impedance having a surface resistance R_{S1}, wherein

$$\mu_r'' = \frac{R_{S1}}{\eta_0 \beta_0 d}$$

the value of surface resistance being chosen so as to provide the imaginary component of permeability.

11. The method of 9, wherein the value of surface reactance is chosen using electromagnetic modeling of the metamaterial structure, the metamaterial structure being configured to provide the value of surface reactance.

12. The method of claim 11, wherein an optimization algorithm is used to configure the metamaterial structure so as to provide the value of surface reactance.

13. The method of claim 11, wherein the optimization algorithm is a genetic algorithm.

14. The method of claim 9, wherein the required real component of permeability is negative.

15. A structure providing a required permeability at a predetermined frequency, the structure comprising:

a dielectric substrate, having a first side and a second side, and having a dielectric thickness and a dielectric constant;

an electrically conducting layer disposed on the first side of the dielectric substrate; and

a frequency selective surface disposed on the second side of the dielectric substrate,

wherein the surface impedance of the structure at the operating frequency is selected so as to provide the required permeability.

16. The structure of claim 15, wherein the frequency selective surface includes a two-dimensional array of conducting elements.

17. The structure of claim 16, wherein the structure has the properties of a ferrite film.

18. The structure of claim 15, wherein an optimization technique is used to select the surface impedance.

19. The structure of claim 15, wherein the structure is an electromagnetic absorber.

20. An antenna including the structure of claim 15.

21. A microwave device including the structure of claim 15.